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Active Use of the Natural Environment for Emotion Regulation

Svein Åge Kjøs Johnsen*[ab], Leif W. Rydstedt[a]

[a] Lillehammer University College, Faculty of Social Sciences, Department of Psychology, Lillehammer, Norway. **[b]** Norwegian University of Science and Technology, Department of Psychology, Trondheim, Norway.

Abstract

Two studies on the use of nature for emotion regulation were conducted. Study 1 (N = 35) ran over two weeks and was an experimental investigation. Participants in the experimental condition were asked to use a picture of nature actively as environmental stimuli for emotion regulation in their everyday life, while two control groups simply looked at a picture of nature or a picture of balloons each evening. A significant effect of the manipulation was found on positive mood, but the effect was complex with an initial increase and then a decrease. There were no findings on negative mood. Study 2 (N = 473) explored the motivational tendency to seek out nature when the participants were happy or sad. A novel concept (expectancy construct) was introduced to measure the perception of the emotion regulatory potential of different environments. The classical natural environment was rated highest on emotional potential of all environments tested here. Perceiving a higher emotional potential in nature was related to a higher intention to seek out nature when happy or sad. Personality and mood were also related to these concepts. Higher positive mood was related to the intention to seek out nature when happy. Conscientiousness was related to a more positive perception of nature. The studies support the notion that using nature may be an effective strategy for regulating one's emotions.

Keywords: nature, emotion regulation, self-regulation, environment, mood, person-environment studies

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*Corresponding author at: Lillehammer University College, Faculty of Social Sciences, Department of Psychology, N-2604 Lillehammer, Norway. E-mail: svein.johnsen@hil.no

Introduction

In contrast to many other strategies, actively using the environment for emotion regulation does not focus directly on altering the cognitive or emotional processes of the individual. Historically, however, research in this area has been more focused on intrapsychological characteristics than on the environmental usage perspective. It may be timely to ask how important the environment really is in relation to cognitive and emotional processes; perhaps it is all too easy to forget this perpetual ground to the figure of mental life. Related to this, philosophers have argued that cognitive operations may extend into the environment in ways that make the role of the environment a more active one (Clark & Chalmers, 1998). There is reason to believe that adaptive emotion regulation is beneficial to health and well-being (DeSteno, Gross, & Kubzansky, 2013), and strategies that involve the environment are particularly interesting because they may be considered strategies that take place earlier in the emotion generative process (Gross & Thompson, 2007). In addition, environmental emotion regulation strategies have the advantage that they may be easier to implement. But we need to know more about how such strategies are related to psy-

chological health. One promising example of environment-focused emotion regulation entails seeking out or using nature (e.g., Johnsen, 2011; Korpela, 1995).

The present work draws on two theoretical perspectives: Firstly, the environmental self-regulation hypothesis, which states that one's favourite places, may be, and in fact are, used for the purpose of self-regulation (Korpela, 1995, 2003). The central idea is that favourite places have attributes that support self-regulation. The second theoretical perspective applied in this study, the process model of emotion regulation, states that emotion regulation may occur prior to or subsequent to the activation of an emotion, termed antecedent- and response-focused regulation, respectively. In the process model of emotion regulation, environment-focused regulation would primarily be antecedent focused, and occur within the stages of situation modification and situation selection (Gross, 1998; Gross & Thompson, 2007). Emotion regulation can involve attempts to alter the magnitude, duration, onset, and offset of emotional responses (Gross, 1998). One may regulate one's emotions by manipulating the situation, or one may choose to seek out situations that increase or reduce certain emotions. Using nature for emotion regulation would involve situation modification, but there may also be some overlap with another antecedent focused strategy, attentional deployment (i.e., distraction; see Gross & Thompson, 2007).

Equally important to the present study are theories and empirical findings about the relevance of the natural environment for emotion regulation. Ulrich's (1993) psycho-evolutionary theory states that human-beings have evolved restorative responses to nature. An exposure to nature, according to this theory, will reduce negative emotions and increase positive emotions (affective restoration). And research supports this; being exposed to a natural environment after watching a frightening movie has been shown to improve mood more than being exposed to a built environment (van den Berg, Koole, & van der Wulp, 2003). Attention restoration theory states that exposure to natural environments will restore cognitive function (Kaplan & Berman, 2010; Kaplan & Kaplan, 1989). In fact, it has been shown that pictures of nature presented for 15 seconds may restore attentional capacity (Berto, 2005). Recently the theory has been expanded to include the ego depletion perspective, indicating that an exposure to nature may also counteract ego depletion effects (Kaplan & Berman, 2010). The concept of ego depletion refers to the idea that the exercise of self-control on a task will reduce the resources for self-control one has available to use on a following task (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, Sparks, Stillman, & Vohs, 2008). This means that an exposure to nature should restore cognitive resources more quickly, and in turn enabling the processing of emotional information.

Although several studies have been able to demonstrate the positive effects on mood and attention of an exposure to nature (e.g., Berman, Jonides, & Kaplan, 2008; Bowler, Buyung-Ali, Knight, & Pullin, 2010; Hartig, Evans, Jamner, Davis, & Gärling, 2003; van den Berg et al., 2003), research has focused less on the everyday uses of nature in relation to emotion regulation. However, a few relevant studies have been conducted. The use of favourite places for self-regulation is highly similar to the use of nature for emotion regulation, and one experimental study showed positive effects (on restorative experiences) of prescribing visits to a favourite place once per day, although only one third of the visits in this study were to natural environments (Korpela & Ylén, 2009). There are a few non-experimental studies that have studied the environmental usage perspective (e.g., Korpela, Hartig, Kaiser, & Fuhrer, 2001), but especially germane to the present work are two studies. One studied teachers' place choices in relation to their levels and sources of stress, and the results indicated that teachers who experience higher levels of vocational stress may cope by seeking nature in order to get away (Gulwadi, 2006). In the second study, Korpela (2003) showed that negative feelings often precede people's visits to their favourite places (mostly natural places) and positive feelings dominate after the visits.

The purpose of Study 1 was to test whether using the natural environment to regulate emotions is an effective strategy, in particular that it can increase positive mood and decrease negative mood. In Study 2, we wanted to investigate the perception of different environments (among them natural environments) with regards to emotion regulation, and the emotion-dependent motivational tendency to visit different environments.

Study 1

The purpose of Study 1 was to investigate whether everyday use of nature for emotion regulation would be effective, and subsequently have an impact upon emotions and cognitive functions. An experimental design was used to investigate this. If this strategy for emotion regulation is effective we expected the following (within subjects) changes over time for those in the experimental group(s): reduced negative mood (Hypothesis 1a), increased positive mood (Hypothesis 1b), and a beneficial impact upon cognitive functions (Hypothesis 2). In addition, over time, this might lead to between group differences, and accordingly we expected that the nature group would at end of treatment experience lower negative mood (Hypothesis 3a), higher positive mood (Hypothesis 3b), and higher cognitive functioning (Hypothesis 4) than the control group.

Method

Participants — Participants in this study were sixty four (mainly second year) psychology students at a Norwegian college and 69% were females. Most participants were recruited in the lecture hall during mandatory coursework, but a few were approached in the library. All participants gave their informed consent, and agreed to participate in the study. They received no monetary compensation or course credit for participating. Sixty four questionnaires were handed in on the first day (at baseline). After one week, forty one participants handed in the questionnaire and at two weeks, thirty five participants handed in the questionnaire. There were no significant differences between those who dropped out after baseline and those that did not on positive mood, negative mood, or ego restoration (*p*s > .05).

Measures — To measure mood, we used the Norwegian version of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). This measure has also previously been used in studies of exposures to nature (e.g., Berman et al., 2008). The participants were instructed to rate, on a 1-5 scale, how they had been feeling the last couple of days, including today. The reliabilities (Cronbach's α) for time one, two, and three were PA: .83, .88, and .88, and NA: .75, .76, and .77.

For this study we also used the most recent version of the Attentional Function Index (AFI; Cimprich, Visovatti, & Ronis, 2011). This scale measures perceived cognitive functioning in everyday activities that require working memory and executive attention. People are asked to rate their level of functioning on 13 items relating to remembering, planning, and maintaining focus, for example: "Getting started on activities (tasks, jobs) you intend to do". Cimprich et al. (2011) conducted exploratory factor analyses with the scale, and divided it into three sub-scales, effective action (1), attentional lapses (2), and interpersonal effectiveness (3). Previous versions of this scale have been used to study the cognitive effects of an exposure to nature (e.g., Duvall, 2011). The instrument was translated into Norwegian, back translated by a native English speaker (who is fluent in Norwegian and has a degree in psychology), and then both translations were evaluated against the original. At baseline (*N* = 64), the reliabilities of the three part-scales of the AFI were .78, .30, and .71, making factor one and three acceptable, and factor two unacceptable.

We also used the Ego Restoration Scale (Johnsen, 2012) to investigate possible effects of the nature exposure on cognitive functions. This three item scale is assumed to measure changes in the strength aspect of self-regulation (see Baumeister et al., 1998). In theory, the restoration of attention should also restore self-regulatory strength (Kaplan & Berman, 2010), and the scale attempts to measure such changes through perceived changes in willpower. The scale is measured on a 1-7 scale (*not at all - to a high degree*). Previous research has found the scale to be highly related to the use of nature for emotion regulation and the concept has been termed ego restoration (Johnsen, 2012). The reliability of this scale was good, the Cronbach's α's for start, end, and middle were .90, .88, and .90.

Procedure — The study investigated whether using the natural environment for self- and emotion regulation would have any impact on mood and cognition. To this end, we included three conditions (*N*s at mid-point): One control group ($N = 14$), one experimental group ($N = 14$), and one experimental/control group with a softer manipulation ($N = 13$). The participants received envelopes which contained instructions, three questionnaires with dates of completion printed on them, and environmental stimuli in the form of A4 size pictures. The envelopes were in random order, unknown to the experimenter, and the envelopes were also distributed among the participants in a non-systematic way. The experiment ran over two weeks and the three questionnaires were identical, the first questionnaire was filled out on the first day, the second on the same weekday one week later, and the third one week after that. The instructions stated that the questionnaires should be completed approximately mid-day.

The experimental group envelope contained two pictures of natural environments (Figures 1 and 2). The instruction read: *In this project we are interested in the use of art and pictures as distractions – and whether this has any effect. We want you to bring these pictures with you and use them actively in your daily life. If you need to think about something, reflect upon something that has happened, or if you are a bit sad/angry/annoyed or similar, then use these pictures actively. Look at them while you are reflecting. Or let your thoughts wander. We ask that you do this instead of what you would normally do if you need a distraction. Common distractions may include watching TV, playing computer games, or using the internet. Look at the pictures for as long as you feel you need to.*

The envelope for the experimental group (2) with the softer manipulation contained one of the pictures of a natural environment (Figure 1). And the instruction read: *In this project we are interested in the use of art and pictures as distractions – and whether this has any effect. Bring this picture home with you, hang it in your room and look at it at least once every evening.*

The control group received an envelope which contained a picture of balloons, this was chosen among several alternatives, first because it was clearly not about nature, and second because it was a neutral picture, and yet somewhat positive (Figure 3). The instructions were the same as the one for the second experimental group.

This study was conducted during the spring, since during the summer the quality of the environment where the college is located in terms of greenness is very high, and during the winter we assumed that the large discrepancy between the environmental stimuli and the outdoor environment might have an impact in itself. We used pictorial stimuli to achieve some measure of control over the environments used. The participants were told not to discuss the study with anyone before the study had ended.

Results

There were no significant findings (using between and repeated measures ANOVAs, *p*s > .05) with the two reliable sub-scales of the Attentional Function Index. Summary statistics of the outcome measures are shown in Table 1.

Figure 1. Experimental group and nature control group picture used in Study 1.

Figure 2. Experimental group picture used in Study 1.

To investigate whether using nature for emotion regulation had any impact on mood, we conducted two mixed between-within (3 × 3) repeated measures ANOVAs. The three groups (experimental conditions) were entered as a between-group factor, and the mood measures (PANAS) at three time points (start, middle, and end) were entered as within-group factors. There was a main effect (of time) on negative mood, $F(2,64) = 4.571$, $p = .014$, *partial* $\eta^2 = 0.125$, which we did not expect. The decrease in negative mood can be observed for all groups in Table 1. In addition, the interaction was non-significant $F(4,64) = 0.821$, $p = .517$, *partial* $\eta^2 = 0.049$. There was no main effect on positive mood, $F(2,64) = 0.415$, $p = .662$, *partial* $\eta^2 = 0.013$. However, the group × time interaction was significant, $F(4,64) = 3.314$, $p = .016$, *partial* $\eta^2 = 0.172$. This last result supports Hypothesis 1b; there was an increase in positive mood in the experimental group(s). Relative to baseline, positive mood increased in both

Figure 3. Control group picture used in Study 1.

experimental groups, while in the control group, positive mood decreased (see Table 1). It was also tested whether this effect on positive mood held when comparing the experimental group against the nature control group only, to compare the nature exposure effect with the use of nature effect. This analysis indicated a significant main effect of time (positive mood increased in both groups), $F(2,44) = 3.239$, $p = .049$, *partial* $\eta^2 = 0.128$, but also a significant group × time interaction was found, $F(2,44) = 3.543$, $p = .037$, *partial* $\eta^2 = 0.139$. That is, there was a main effect of nature exposure on positive mood, but there was also a difference between the two nature groups. In order to investigate this difference specifically, we considered the within-subject contrasts in an analysis of the experimental group alone. This analysis yielded a non-significant linear component, but a significant quadratic component for the main effect, $F(1,11) = 11.421$, $p = .006$.

We also conducted a mixed ANOVA with the ego restoration scale. The Mauchly test showed that the assumption of sphericity was violated; therefore the Greenhouse-Geisser values are reported. The results indicated a non-significant main effect, $F(1.557, 46.701) = 1.571$, $p = .221$, *partial* $\eta^2 = 0.050$. And the group × time interaction was non-significant as well, $F(3.113, 46.701) = 1.304$, $p = .284$, *partial* $\eta^2 = 0.080$.

In order to investigate between group differences, the groups must be similar at baseline. The results demonstrated no significant differences between the groups at baseline: Negative mood: $F(2,38) = 1.67$, $p = .202$; Positive mood: $F(2,38) = 1.96$, $p = .155$; Ego restoration $F(2,38) = 0.20$, $p = .823$). But there were no differences between the groups at end of treatment either: Negative mood: $F(2,32) = 0.49$, $p = .618$; Positive mood: $F(2,32) = 0.27$, $p = .763$; Ego restoration: $F(2,32) = 2.61$, $p = .089$. We also conducted analyses with the combined nature group compared with the control group; the groups were similar at baseline: Ego restoration: $F(1,39) = 0.17$, $p = .679$; Negative mood: $F(1,39) = 1,11$, $p = .298$; Positive mood: $F(1,39) = 3.96$, $p = .054$. At end of treatment, there were no differences on mood (Fs < 1, ps > .05), but a significant difference between the groups on ego restoration: $F(1,33) = 4.795$, $p = .036$. This last result supports Hypothesis 4, but we found no support for Hypothesis 3.

Table 1

Summary Statistics Over Time for Experimental Study

	Summary statistics over time					
	Start of treatment		Middle of treatment		End of treatment	
	M	*SD*	*M*	*SD*	*M*	*SD*
Experimental group						
PA	3.30	0.55	3.59	0.65	3.42	0.69
NA	1.81	0.58	1.49	0.37	1.51	0.37
Ego restoration	4.64	1.18	4.39	0.82	4.44	0.87
Experimental group 2						
PA	3.35	0.58	3.43	0.72	3.60	0.64
NA	1.55	0.35	1.48	0.44	1.40	0.34
Ego restoration	4.41	1.18	4.51	1.30	4.83	1.32
Control group						
PA	3.70	0.60	3.46	0.64	3.55	0.52
NA	1.53	0.36	1.44	0.30	1.37	0.35
Ego restoration	4.36	1.45	3.62	1.87	3.58	1.74
Combined nature group						
PA	3.33	0.56	3.52	0.68	3.51	0.66
NA	1.69	0.49	1.48	0.40	1.45	0.35
Ego restoration	4.53	1.16	4.45	1.06	4.64	1.11

Discussion

The results gave a partial support for the idea that actively using nature for emotion regulation is an effective strategy. We found support for one of our hypotheses regarding active usage; using nature for emotion regulation had an effect on positive mood. In addition, the analysis of the combined nature group indicated that nature exposure in general may have an effect on positive mood.

The effect on positive mood of using nature appears to be rather complicated. After the first week we observed an increase in positive mood, but towards the end of the experiment positive mood decreased (although remaining above the baseline level). One explanation is that the manipulation was too invasive; the participants were told *not* to do what they normally would do when experiencing negative emotions. In addition, the contrast analysis showed that the effect may be quadratic. Accordingly, the present study indicates that relying exclusively on this strategy for emotion regulation is not recommended.

While the experimental group reported slightly higher negative mood than the other two groups at baseline, the groups were not significantly different in mood at any time point. The higher negative mood in the experimental group at baseline may explain why there were no group differences at middle or end.

Low power (small number of participants) may explain why there were no between group differences when comparing the experimental group and the two control groups. Moreover, we did not monitor whether the participants followed the instructions given, and some may have adhered less strongly to them. In addition, it is possible that the participants in the two control group used their pictures for emotion regulation as well, although this option would have been time-constrained. Finally, as indicated above, the experimental instruction may also have been

too invasive, because the participants were urged to exclude other strategies (effective or ineffective ones), which could contribute to statistical noise.

Using nature for distraction, or emotion regulation, may influence cognitive functioning. The results showed that the combined nature group experienced higher levels of willpower, termed ego restoration, at end of treatment, when compared with the control group. A tentative conclusion may be that indirect representations of nature have a beneficial impact on restoration of willpower.

This study raises two important questions. First, what is the role of the other environments in which people find themselves? How important is the environment one moves away from when one seeks nature? Environmental deprivation may play a role here. The present study was conducted during springtime and environmental deprivation may have been a factor, although it is difficult to say how important this was because nature was still present in the everyday environment of the participants. Perhaps the results would have been stronger if the participants were living in an urban environment. A related question is whether the discrepancy between the two environments is important. Within attention restoration theory, environmental change is acknowledged, but it is only indicated that the restorative environment should be in some way *different* from one's everyday environment (Kaplan & Kaplan, 1989). The second question raised is whether using nature for emotion regulation becomes less effective over time. People may habituate to nature, and people may certainly habituate to still images of nature. Nevertheless, it seems possible that nature exposure over time could have an effect on positive mood. Although the *active use* of nature may not be a necessary condition in this regard. On the other hand, a clinical population might benefit more from this approach, because it is possible that using nature is more effective for those higher in negative mood, and/or those with some sort of cognitive fatigue (Johnsen, 2011).

Strictly speaking, this study cannot answer the question of whether using a picture of nature to regulate one's emotions is more effective than using any other picture. We can only conclude that after one week the experimental group seemed to benefit emotionally from using nature to regulate their everyday emotions.

Study 2

The purpose of Study 2 was to investigate the perception of nature with regards to emotion regulation, and the intention to use nature for emotion regulation. Specifically, we wanted to explore whether nature is perceived as an environment suitable for emotion regulation, and whether the intention to use nature for emotion regulation would have any impact on mood/affectivity. In addition, the relevance of individual differences (personality and gender) in this regard was explored.

Emotional Potential and Emotion Regulation

That some environments are better suited for certain activities is not a new idea. Research on favourite places takes at its starting point that one can choose to spend time in environments that are well suited for reflecting upon (negative) feelings (e.g., Korpela, 1995, 2003). Korpela (2003) has found that individuals with higher levels of negative mood tend to choose natural environments as their favourite places, and that these favourite places may support emotion regulation.

We suggest a relatively straightforward concept to measure the perceived relevance of an environment for emotion regulation. This concept is called the *emotional potential* of an environment. Emotional potential may be defined as an expectancy construct, *i.e.*, to what extent one expects emotional effects from (being exposed to) an envir-

onment. An environment with the emotional potential to increase positive and reduce negative emotions could actively be used for this very purpose.

Within the process model of emotion regulation, environment-focused emotion regulation would be viewed as a variation of situation selection and situation modification (see Gross, 1998; Gross & Barrett, 2011). The essential point here is that one can choose to spend time in environments one believes will increase, reduce, or maintain a feeling (situation selection). And one may modify a situation once a feeling already has been activated (or if one anticipates a feeling). For example, one may engage the children in a game when stuck in traffic. Expectancy constructs should be highly relevant in both cases because they guide our emotion regulatory choices.

Personality and Emotion Regulation

Meta-analytic and longitudinal studies have demonstrated the relevance of personality traits such as extraversion and neuroticism, but also conscientiousness, for positive and negative affect[i] (e.g., Costa & McCrae, 1980; Steel, Schmidt, & Shultz, 2008). And personality traits may be related to both emotions and moods (e.g., Costa & McCrae, 1980; Larsen & Ketelaar, 1991) and strategies for emotion regulation (see John & Gross, 2007 and Ng & Diener, 2009). The relationship between personality, environment, and mood may be highly complex. Over time, personality could influence one's mood by influencing what environments one seeks out, but it may also influence the emotional significance (impact) of these chosen environments (see Diener, Larsen, & Emmons, 1984; Lucas & Diener, 2008). It is easy to envision self-affirming circles through the seeking of environments that are congruent with one's personality. But it also seems likely that repeated exposure to "healthy" environments should have an impact upon one's mood. Summing up, personality traits may, to varying degrees, moderate the emotional impact of an environment, and mood and emotional well-being over time. In addition, environmental choices may, if they are systematic over time, partially mediate the effect of personality on mood, but this, and any direct effects of seeking environments on mood, must be an accumulation of emotional experiences. To conclude, given the relations between personality and affect, it is important to account for the variance in mood due to personality. Similarly, gender differences in mood and emotion are also relevant to consider (e.g., Grossman & Wood, 1993), that is, emotion regulatory choice is likely to be influenced by type and intensity of experience.

In this study, we developed a scale to measure the perceived emotional potential of nature (and other environments). It seems likely that this kind of scale, measuring the expected emotional effects of different environments, may be of interest and relevance in a variety of other contexts as well. For example, this scale could be used when emotional processes and well-being (in an environment) are relevant to consider, and not merely immediate reactions. Previous research has demonstrated that natural environments receive higher ratings of positive affect than urban environments (e.g., van den Berg et al., 2003; White et al., 2010). Accordingly, we hypothesized that nature would be rated higher on emotional potential than the other environments (H1a), and moreover, that perception would be related to intention; those perceiving a higher emotional potential in nature should also be more inclined to seek out nature (H1b). In addition, we studied the intentions to seek out different environments (motivational tendencies), in order to explore the participants' tentative orientation towards specific environments. We hypothesized that the motivational tendency to seek out nature when experiencing a negative emotion would be related to a more positive and less negative mood (the regulation Hypothesis, H2), and that the motivational tendency to seek nature when experiencing a positive emotion would be related to higher positive mood and lower negative mood (the savouring Hypothesis, H3).

To explore these hypotheses we analysed the participants' reactions to a small sample of environments. In similar research, studies often compare natural environments with urban environments (Velarde, Fry, & Tveit, 2007). The present study stands within this tradition, but we wanted to include a few indoor environments and one atypical natural environment as well.

Method

Participants — The participants in Study 2 were 473 college students (17% studied psychology). 66.2% were female and the mean age of the participants was 22.6 years old. By using lists of active enrolled students we calculated that 57.4% of the population of students at this college participated in this study.

Environmental Stimuli — We started with fifty six pictures in total that represented six different everyday environments: urban environments with people, urban environments without people, "unsafe or scary" natural environments, living rooms, shopping malls, and classical natural environments. A panel (N = 7) rated the pictures on the degree to which they were the typical examples of their environmental categories, and based on this six picture were selected (see Figures 4-9). A focus group was recruited to check the validity of the six pictures, essentially to ascertain whether people think of these categories when seeing the pictures. The focus group (N = 12, six women) was asked to give their most basic associations to the six selected pictures. Specifically, the participants were asked to give the first association that came to mind, and the researcher asked for more associations several times until it appeared that no new associations were reported. After the list for each picture had been produced the participants were asked to raise their hand if they agreed with each of the associations. The agreements on these associations were counted. In general, the results confirmed the original categories, but the highest concordance was for classic nature, urban environment with people, and the shopping mall. Only the associations agreed upon by 50% or more are reported. The "urban environment with people" produced the following associations and number of people agreeing: *outside* (12), *street* (11), *people* (12), and *nice weather* (12). The "classic nature" picture produced the following associations: *river* (9), *nature* (12), *landscape* (12), *the mountain* (6), *Norway* (12). And the "shopping mall" produced the following associations: *shopping mall* (12), *city* (12), *floors* (12), *Oslo City* (a shopping mall) (9), "*lots of people*" (12), *glass ceiling* (10), *busy* (11). "Urban environment without people": *city* (11), *grey* (8), *bad weather* (8), *downhill* (11), and *blocks* (10). "Unsafe (atypical) nature": *forest* (12), *evening* (9), *dusk* (10). "Living room": *evening* (12), *living room* (10), *lamp* (12), and *reading corner* (7).

Figure 4. Urban environment with people (Study 2).

Figure 5. Urban environment without people (Study 2).

Figure 6. Unsafe/atypical nature (Study 2).

Figure 7. Classic nature (Study 2).

Figure 8. Living room (Study 2).

Figure 9. Shopping mall (Study 2).

Measures — Extraversion and neuroticism was assessed with the Norwegian version of the big five inventory (BFI-44; Engvik & Føllesdal, 2005; John & Srivastava, 1999). Positive and negative mood were measured using the Positive and Negative Affect Schedule (PANAS) (Watson et al., 1988), with the instruction to indicate *how you generally feel*. The intention to seek out nature was measured with two questions: "I would seek this environment if I was sad" and "I would seek this environment if I was happy". The questions were verbally anchored from 1-7,

highly disagree to *highly agree*. It was assumed that these two items indicated a motivational tendency or an *intention* to seek out nature when happy or sad, and that this intention should be closely related to savouring happy feelings, and regulating negative feelings.

Emotional potential was measured by four items: "Being in these surroundings would make me happier"; "Being in these surroundings would make me less happy"; "Being in these surroundings would make me sadder"; "Being in these surroundings would make me less sad". These items were submitted to exploratory factor analysis (principal axis factoring with promax rotation). The factor analysis extracted a total of seven factors, but the last factor seemed to be the result of over-factorisation, for example, most items loaded lightly on this factor, and unsystematically. In addition, it was apparent that the items that related to the six different environments (pictures) organised into the first six factors (one for each environment). Therefore, a six factor solution was used which accounted for 55.16% of the variance (the seven factor solution accounted for 59.85%). The six factors consisted of items relating to the same picture. Pattern matrix cross loadings were very low, typically below 0.10 (max 0.14), and factor loadings were typically very high, about 0.70 (min 0.43). Moreover, the six factors formed a bipolar organisation, with negative loadings for the items "...less happy" and "...sadder", and positive loadings for the items "...happier" and "...less sad". Thus, we reversed the negative items and calculated mean emotional potential scales for each environment. The reliabilities (Cronbach's *α)* of these scales were good. See Table 2 for means, standard deviations, item ranges, and Cronbach's α's for all measures.

Procedure — The pictures of the six different environments were presented in softly lit lecture halls using an image projector. The participants viewed the pictures and indicated their immediate reactions to them on the questionnaire.

Results

Pair wise comparisons were conducted using paired samples *t*-tests and all environments were tested against the classical natural environment on emotional potential and the intention to seek out the environments when happy/sad. Hypothesis 1a stated that nature would be rated highest on emotional potential. The results supported this: *classic nature* obtained significantly higher score on emotional potential than the other environments: compared with the urban environment with people: $t(465) = 11.197$, $p < .001$, $d = 0.71$; urban environment without people: $t(463) = 30.400$, $p < .001$, $d = 2.00$; unsafe nature: $t(462) = 34.566$, $p < .001$, $d = 2.15$, living room: $t(464) = 24.047$, $p < .001$, $d = 1.58$; shopping mall: $t(464) = 11.422$, $p < .001$, $d = 0.76$. Cohen's *d* was computed by dividing the difference in means by the pooled standard deviation, as recommended for repeated measures designs (see Dunlap, Cortina, Vaslow, & Burke, 1996). According to Hypothesis 1b, the perception of the emotional potential of nature should be associated with the intention to seek out nature. The results supported this, emotional potential correlated with the intention to seek nature when happy ($r = .62$, $p < .01$), and sad ($r = .21$, $p < .01$).

The participants seemed to prefer seeking classic nature when happy (savouring) over the other environments. Compared with urban environment with people: $t(464) = 11.823$, $p < .001$, $d = 0.71$, urban environment without people: $t(463) = 25.165$, $p < .001$, $d = 1.61$, unsafe nature: $t(461) = 30.948$, $p < .001$, $d = 1.86$, living room: $t(463) = 16.272$, $p < .001$, $d = 1.04$, shopping mall: $t(461) = 3.836$, $p < .001$, $d = 0.25$. In general, the participants did not report a particularly strong motivational tendency to seek any of the environments when sad (see Table 2). However, classic nature was rated higher than most environments on the intention to regulate sadness. Compared with urban environment with people: $t(461) = 13.641$, $p < .001$, $d = 0.78$, urban environment without people: $t(458) = 7.538$, $p < .001$, $d = 0.46$, shopping mall: $t(462) = 10.530$, $p < .001$, $d = 0.62$, unsafe nature: $t(461) = 0.892$, $p = .373$, $d = 0.06$, living room: $t(462) = -0.838$, $p = .403$, $d = 0.05$.

Table 2

Means, Standard Deviations, and Item Ranges of Measures

	Mean	Standard deviation	Item range	Cronbach's α
Extraversion	4.64	0.91	1-7	.78
Emotional Stability (N)	4.52	1.08	1-7	.81
Conscientiousness	4.62	0.88	1-7	.78
Negative mood	1.83	0.49	1-5	.78
Positive mood	3.53	0.52	1-5	.78
Urban env. w/ people				
Would seek if happy	4.26	1.46	1-7	-
Would seek if sad	2.67	1.65	1-7	-
Emotional potential	4.96	1.04	1-7	.76
Urban env. w/o people				
Would seek if happy	3.08	1.36	1-7	-
Would seek if sad	3.26	1.52	1-7	-
Emotional potential	3.69	1.01	1-7	.76
"Unsafe" nature				
Would seek if happy	2.59	1.51	1-7	-
Would seek if sad	3.93	1.76	1-7	-
Emotional potential	3.19	1.31	1-7	.86
Classic nature				
Would seek if happy	5.24	1.32	1-7	-
Would seek if sad	4.04	1.81	1-7	-
Emotional potential	5.67	0.96	1-7	.83
Living room				
Would seek if happy	3.82	1.41	1-7	-
Would seek if sad	4.12	1.46	1-7	-
Emotional potential	4.09	1.05	1-7	.81
Shopping mall				
Would seek if happy	4.87	1.64	1-7	-
Would seek if sad	2.94	1.80	1-7	-
Emotional potential	4.78	1.35	1-7	.85

There were gender differences in intention, but not in the perception of nature. Seek out if sad, males (M = 3.81, SD = 1.77), females (M = 4.17, SD = 1.82), $t(460) = 2.009$, $p = .045$, $d = 0.20$. Seek out if happy, males (M = 4.93, SD = 1.42), females (M = 5.40, SD = 1.25) $t(460) = 3.620$, $p < .001$, $d = 0.36$. Emotional potential, males (M = 5.66, SD = 0.97), females (M = 5.68, SD = 0.96), $t(461) = 0.234$, $p = .815$, $d = 0.02$.

We conducted regression analyses to test whether the motivational tendency to seek nature when sad or happy (emotion regulation) could predict positive and negative mood. Personality traits (extraversion, emotional stability, and conscientiousness) and gender were entered in the first step, and the intention items (happy/sad) with regards to classic nature were entered in the second step. The dependent variable was positive mood (PA from the PANAS scale). This resulted in a significant R^2-change ($F = 5.114$, $p = .006$). All predictors were significant at the .05 level, except the "would visit if sad" item ($p = .066$). Using negative mood (NA) as dependent variable did not result in a significant R^2-change ($F = 1.015$, $p = .363$). We assumed there might be gender differences and con-

ducted separate regression analyses with males and females. As before, we entered conscientiousness, extraversion, and emotional stability in the first step and the intention items in the second. The results from these analyses, with PA as dependent variable, are shown in Tables 4 and 5. For males, the "would seek if happy" item was a significant predictor of PA, while for females, the "would seek if sad" item was a significant predictor of PA. Summing up, the motivational tendency to seek the natural environment when happy was correlated with positive mood (see Table 3), and predicted positive mood for males (see Table 5).The intention to seek the natural environment when sad was found to be a significant predictor of positive mood for females (see Table 4), but it was not correlated with positive mood (Table 3).

Table 3

Correlations Between Emotional Potentials and Intentions to Seek Different Environments, and Mood/Personality

	PA	NA	Emotional Stability	Extraversion	Conscientiousness
Classic nature					
Would seek if sad	.02	.07	-.05	-.10*	.02
Would seek if happy	.13**	.02	-.03	.01	.22**
Emotional potential	.15**	-.09*	.08	.03	.17**
Urban w/ people					
Would seek if sad	.04	.07	-.00	.05	.03
Would seek if happy	.02	.06	-.13**	.06	-.04
Emotional potential	.04	-.08	-.01	.13**	.00
Shopping mall					
Would seek if sad	.01	-.01	-.01	.04	.03
Would seek if happy	-.05	.12**	-.23**	.08	.03
Emotional potential	-.06	-.00	-.14**	.09	.11*
Urban w/o people					
Would seek if sad	.00	.12*	-.06	-.15**	.00
Would seek if happy	-.02	-.05	.03	-.01	-.05
Emotional potential	-.07	-.12**	.09*	-.04	-.09
Unsafe nature					
Would seek if sad	-.02	.17**	-.11*	-.09	-.05
Would seek if happy	.05	.00	.12**	-.06	.03
Emotional potential	.04	-.01	.21**	-.05	-.03
Living room					
Would seek if sad	.01	.03	-.07	.01	-.07
Would seek if happy	.05	-.01	-.02	.02	-.05
Emotional potential	.07	-.07	.04	.05	-.05

*$p < .05$. **$p < .01$.

There were no significant differences in mood between the groups that reported that they would seek nature when sad/happy (agreement 5-7 on the Likert-type scale) and the groups that did not (agreement 1-4), all *p*s > .15. However, when endorsement of savouring (positive emotion regulation) was higher (6-7), there was a significant difference between the high intention group and the low intention group (agreement 1-5) on positive mood (PA): high intention ($M = 3.63$, $SD = 0.54$), low intention ($M = 3.45$, $SD = 0.49$), $F(1,463) = 13.688$, $p < .001$, $d = 0.35$. But there was no difference on negative mood (NA), high intention: ($M = 1.81$, $SD = 0.45$), low intention ($M = 1.84$, $SD = 0.52$), $F(1,463) = 0.628$, $p = .428$, $d = 0.06$. And interestingly, positive mood was higher among those with

Table 4

Hierarchical Multiple Regression of Positive Mood (PA) onto Personality and the Use of Nature for Emotion Regulation (Females, N = 313)

	Model 1			Model 2		
	β	*t*	*p*	β	*t*	*p*
Extraversion	.46	9.974	<.001	.47	10.211	<.001
Emotional Stability	.15	3.228	.001	.15	3.226	.001
Conscientiousness	.28	6.221	<.001	.27	5.909	<.001
Seek if happy				.04	0.776	.438
Seek if sad				.10	2.185	.030
R^2	.44			.45		
F change	78.877**			3.419*		

*p < .05. **p < .01.

Table 5

Hierarchical Multiple Regression of Positive Mood (PA) Onto Personality and the Use of Nature for Emotion Regulation (Males, N = 155)

	Model 1			Model 2		
	β	*t*	*p*	β	*t*	*p*
Extraversion	.49	7.079	<.001	.49	7.080	<.001
Emotional Stability	.05	0.699	.486	.06	0.891	.374
Conscientiousness	.31	4.732	<.001	.28	4.245	<.001
Seek if happy				.16	2.310	.022
Seek if sad				-.01	-0.125	.901
R^2	.37			.40		
F change	29.019**			2.860		

*p < .05. **p < .01.

higher endorsement of the negative emotion regulation item, although the difference was not significant, high intention (M = 3.62, SD = 0.55), low intention (M = 3.51, SD = 0.51), $F(1,463) = 3.438$, p = .064, d = 0.21. The high endorsement group also reported higher negative mood, but the difference was not significant, high intention (M = 1.87, SD = 0.54), low intention: (M = 1.81, SD = 0.47), $F(1,463) = 1.187$, p = .276, d = 0.12.

Of course, this may not be about nature at all; any environment could be sought for the purpose of emotion regulation or self-regulation, and be effective. In order to test for this possibility, we compared responses to the classic natural environment with responses to all six environments. We conducted the same hierarchical regression analyses as with the natural environment, adding gender and personality traits in the first step and the intention items in the second. The results showed that adding the intention items resulted in a significant R^2-change only in one analysis. For the "unsafe" natural environment, seeking if sad predicted negative mood (β = .11, p = .004), that is seeking this environment positively predicted negative mood when controlling for personality and gender. Moreover, three of the intention items correlated positively with negative mood (see Table 3).

Discussion

The present study introduced a novel concept, emotional potential, to measure the perceived relevance of an environment for emotion regulation. This *expectancy construct* refers to the belief that an environment will increase positive and decrease negative emotions. Emotional potential seems to be a reliable and coherent measure. The

perceived emotional potential of nature appears to be high. This supports previous research findings on the association between nature and positive affect (e.g., van den Berg et al., 2003; White et al., 2010). However, this may not be true for all natural environments; the picture of the unsafe natural environment was rated significantly lower on emotional potential than the classical natural environment.

We found some support for both the savouring and the regulation hypotheses. Positive mood was associated with the intention to seek nature when happy (savouring). This could indicate that the strategy is effective in increasing or maintaining positive mood. On the other hand, it may be that people higher in positive mood are more outgoing, more oriented towards seeking environments in general. Of course, then such associations should also be found with the other environments. Both intentions, to seek out nature when happy, and sad, could predict positive mood in the regression analyses, but there was a gender difference here. For males, the intention to seek out nature when happy was a significant predictor of positive mood, while for females, the intention to seek out nature when sad predicted positive mood.

The intention to seek nature was not associated with negative mood. This could indicate that the impact upon negative mood is more indirect (see below). When the participants were divided into groups based on endorsement of the items, perhaps indicating a stronger tendency to *actually* seek out nature when happy or sad, we found a higher level of positive mood among those showing a tendency towards savouring, and this difference was statistically significant. In addition, positive mood was higher among the participants showing a tendency towards negative emotion regulation. This difference was close to being statistically significant. The fact that this group also reported slightly higher negative mood indicates that people with higher negative mood may seek out nature to undo the impact of negative feelings, that is, they may perceive a need to use nature to buffer against their negative mood, and as a result may heighten their positive mood. This fits well with the broaden-and-build theory of positive emotions, where the activation of positive emotions is thought to undo the sequelae of negative emotions (Fredrickson, 1998). This could explain a hypothetical indirect effect on negative mood.

There are two main objections that could be raised against this study; the choice to study only a small number of environments, and the choice to include only two emotions. One important reason for making these choices was the attempt to avoid fatigue among the participants. Two common examples of emotions were selected, one positive and one negative. With regards to the selection of environments there was an additional reason for our approach. Rather than controlling some relevant aspect of the environment, we opted for a more holistic approach and selected a few common *everyday* environments. We were looking for a representation of environments that people might be exposed to daily or weekly. To be useful, the environments should be representative exemplars of their category, and the focus group confirmed this representativeness. Overall, the classical natural environment, the shopping mall, the living room, and the urban environment with people may be judged to be adequate exemplars.

The *type* of natural environment one seeks may be relevant. In the present context, a natural environment showing water and greenery was rated more positively than a natural environment showing a dark forest. The responses to the atypical natural environment could indicate a congruency perspective. That is, seeking a darker natural environment could be a way of validating one's negative mood. And furthermore, this could indicate that it may be easier to project emotions onto nature, both positive and negative, than onto other environments. But it is also possible that we respond more readily to different natural environments, that is, the underlying relevance of natural environments may be clearer to us, as evolutionary analyses have suggested (e.g., Ulrich, 1993).

The relation between the perception of the emotional potential of nature and conscientiousness confirms a previous finding that individuals with a higher score on conscientiousness may appraise nature as highly relevant for their well-being (Johnsen, 2012). This is also in accordance with the idea that conscientious individuals orient themselves towards that which is socially prescribed (see John & Gross, 2007), and have emotional responses accordingly.

The finding that savouring happy feelings in an *urban environment* is weakly related to negative mood might indicate that this is an inefficient strategy. On the other hand, it could simply mean that people with a more negative mood want to avoid public settings even when they are happy. Nevertheless, the finding is intriguing and should be researched further. Generally speaking, the relations between personality, the seeking of affect-congruent and affect-incongruent environments, and emotional responses, should be researched further. There may be some interesting findings here, for example, seeking mood-congruent environments could moderate or mediate the relationship between mood and personality.

Only single items were used to measure intention in this study, it is possible that by using scales, and by including more emotions, the relations will be stronger. It should also be noted that the intentions only referred to a specific picture as a proxy for nature. While our approach made it possible to gather more immediate, and perhaps visceral, reactions to the different environments, asking about these environments in general would probably produce stronger associations.

General Discussion

We have reported results from one experimental and one cross-sectional study of the use of nature for emotion regulation. Taken together, the results from these two studies show that the use of nature for emotion regulation may have real and beneficial consequences for people employing this strategy. The evidence for an effect on positive mood from this strategy seems convincing, at least to some extent. The experimental study showed an initial increase in positive mood for the active usage group and a main effect on positive mood for the combined nature group, and the cross-sectional study showed that more usage of nature for emotion regulation was related to higher positive mood. It was more difficult, however, to demonstrate that this strategy has an effect on cognitive functions. The only finding of relevance was that, at the end of the experiment, ego restoration, which is assumed to measure an increase in willpower, was rated higher in the combined nature group than in the control group. This shows that being exposed to nature may over time have an effect on one's perceived willpower.

Future studies might focus on whether using nature to regulate emotion is effective in increasing positive mood over longer periods of time, and whether this approach may be relevant in a clinical perspective. For example, using nature may be particularly effective for people who cope with their depression by seeking mood-congruent environments. Moreover, further research might also consider the appropriateness of using different environments (e.g., the shopping mall) for emotion regulation.

Emotional potential may be a relevant concept to consider when studying relations between the physical environment (e.g., buildings and neighbourhoods) and well-being. In fact, the present findings indicate that people may perceive nature as highly relevant for emotion regulation. And therefore, taking steps that make the option of visiting nature available to people may contribute to increased well-being and better psychological health in the population.

The results reported here show that it may be of importance which environmental stimuli one chooses for distraction. Given this, one should take a closer and more specific look at what environmental distractions people use, or

prefer. This may be particularly relevant in our modern society where environmental stimuli designed to distract is the rule rather than the exception.

Notes

i) We use the term affect as a general term referring to both emotions and moods. And distinguish between emotions and moods in terms of duration and situational relevance. Mood is a more lasting (days, months) emotional reaction.

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About the Authors

Dr. **Leif W . Rydstedt** is professor in work and organizational psychology with special interest in health consequences of long-term stress exposure, recovery from work stress and the role of personality factors in the stress process.

Cand. Psychol. **Svein Åge Kjøs Johnsen** is a certified clinical psychologist and currently a doctorate student in environmental psychology, specifically environment-focused emotion regulation. Most of his interests are in the intersections between environmental psychology, emotion research, and personality psychology.